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New records of *Agaricales* from Atlantic Forest fragments of Pernambuco, Northeast Brazil

Felipe Wartchow[1]*, Leonor C. Maia[2]
& M. Auxiliadora Q. Cavalcanti[2]

[1] *Universidade Federal da Paraíba, Departamento de Departamento de Sistemática e Ecologia, CEP: 58051-970, João Pessoa, PB, Brazil*
[2] *Universidade Federal de Pernambuco, Departamento de Micologia/CCB, Av. Prof. Nelson Chaves, s/n, CEP: 50670-901, Recife, PE, Brazil*
* Correspondence to: *fwartchow@yahoo.com.br*

Abstract — Some interesting fungi were collected during recent expeditions to Atlantic Forest fragments. *Entoloma aripoanum* is recorded for the first time from Brazil. *Crepidotus flavus*, *E. tucuchense,* and *Lepiota erinana* are new records from Brazil's northeast region, and *Trogia cantharelloides* is new from Pernambuco State. Drawings and descriptions of the species are provided.

Key words — *Agaricaceae*, *Crepidotaceae*, *Entolomataceae*, neotropics, taxonomy

Introduction

The Atlantic Forest, which is a priority area for conservation (Myers et al. 2000), has been drastically diminished by human activity since the beginning of Portuguese colonization (Kimmel et al. 2008, Trindade et al. 2008). Only 11–16% remains of the original forest (Ribeiro et al 2009). Research on fungal diversity is urgently needed in this threatened biome.

In this continuation of previous reports on agarics from Atlantic Forest fragments of Pernambuco (Wartchow 2006, Wartchow & Maia 2007, Wartchow et al. 2007a,b, 2008a,b), we present new records of *Crepidotus* (Fr.) Staude, *Entoloma* (Fr.) P. Kumm., *Lepiota* (Pers.) Gray, and *Trogia* Fr.

Material & methods

Collections were undertaken at the Usina São José (7°50′20″S 35°00′10″W), an area covered by variously sized (12–380 ha) Atlantic Forest fragments among sugar cane fields (Alves-Araújo et al. 2008, Trindade et al. 2008). These preserved fragments shelter 650 species (379 genera, 105 families) of trees, with *Fabaceae*, *Poaceae*, *Cyperaceae*,

Asteraceae, *Euphorbiaceae*, *Myrtaceae*, *Rubiaceae*, *Melastomataceae*, *Araceae*, *Malvaceae*, *Apocynaceae*, *Sapindaceae,* and *Sapotaceae* as the most diverse (Alves-Araújo et al. 2008).

The usual methodology for studying agarics was followed (Singer 1986). Color codes and names follow Maerz & Paul (1950; 'M&P'); x = average dimension. Exsiccates are deposited at URM Herbarium (Thiers 2011).

Taxonomy

Crepidotus flavus Capelari, Mycotaxon 115: 146. 2011. Fig. 1

Pileus 5–14 mm, uniformly sulfur yellow (M&P 10J1 "Sulphur Y, Citrus"), convex with incurved margin in young specimens, then more or less straight, moderately tomentose/pubescent when young, smooth and glabrous in age; context thin, fleshy, cream to pale yellow, unchanging. Lamellae radiating from an attachment point, narrow (<0.5 mm broad) concolorous with pileus, then ferruginous in older basidiomata, crowded, with lamellulae. Stipe absent or very rudimentary.

Basidiospores 6.5–8.5 × 6–8 µm, x = 7.6 × 7.2 µm, Q = 1.00–1.09(–1.11), Qx = 1.05, globose to occasionally subglobose, distinctly punctuate/ echinulate, slightly thick-walled, yellowish brown to pale brown in KOH. Basidia 17–25 × 7–8.5 µm, clavate, mainly 2-spored. Pleurocystidia absent. Lamella edge sterile, with crowded cheilocystidia. Cheilocystidia 20–35 × 8–10 µm, mostly fusoid to utriform/lageniform, very infrequently ellipsoid to somewhat more or less sinuous, thin walled, hyaline. Pileipellis a cutis with hyphae approx. 5 µm wide, radially oriented, walls moderately thick, hyaline, colorless. Lamella trama regular, ≤ 5 µm wide. Clamp connections numerous.

Habitat: gregarious on rotten wood in a fragment of tropical rain forest.

Material examined: **BRAZIL. Pernambuco**, Igarassu, Usina São José ("Mata de Piedade"), 25.viii.2005, *F. Wartchow s.n.* (URM 80088); Moreno, v.2008, RPPN Garnijó, *G.M. Mueller et al. 27* (URM 80089).

Note: The macroscopic features were noted from both collections; microscopic characters were taken almost entirely from URM 80088, except for observations of cheilocystidia in URM 80089.

Remarks: This *C. flavus* collection is characterized by small, sulfur yellow basidiomes with slightly tomentose to smooth pilei, globose to occasionally subglobose basidiospores, clamped hyphae, exclusively 2-spored basidia, and absence of "antler-like" cheilocystidia (Capelari 2011). The last feature is consistent in the current collections as well as in material from São Paulo (Capelari 2011). All features fit with the species concepts given by Senn-Irlet & Immerzeel (2003) for this group.

In the protologue of *C. flavus*, Capelari (2011) tried to segregate this species from *C. sulphurinus* Imazeki & Toki, described from Japan, based on the two-spored basidia described for *C. sulphurinus,* although apparently no basidia

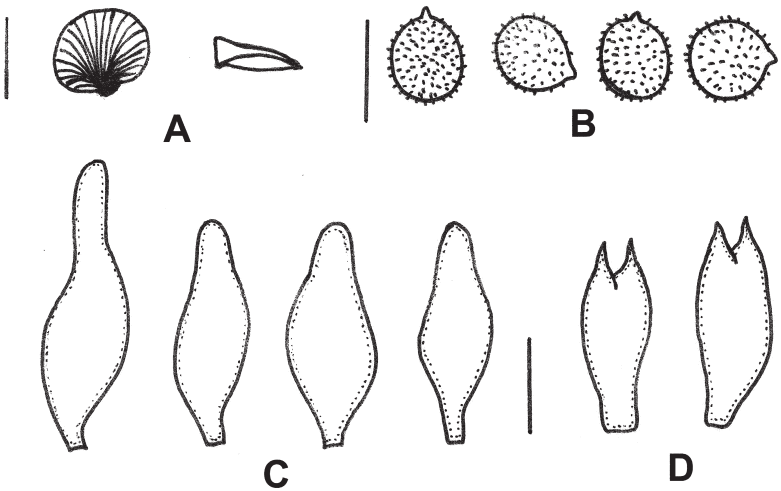

Figure 1. *Crepidotus flavus*.
A. Habit. B. Basidiospores. C. Cheilocystidia. D. Basidia.
Scale bars: A = 10 mm; B–D = 10 µm.

had been found in the original collection of *C. flavus*. According to Imazeki & Toki (1954), *C. sulphurinus* is a disjunct taxon that differs in the less globose basidiospores and somewhat clavate cheilocystidia. On the other hand, our materials agree with the protologue of the São Paulo material in the yellowish pileus and utriform/lageniform cheilocystidia (which Capelari interpreted as ventricose), although larger basidiospores (8.7 × 8.7 µm) were reported in the São Paulo material. Hongo (1961), who described *C. sulphurinus* specimens from Japan, referred to the cystidia as broadly clavate and ventricose, but the basidiospores as subglobose to globose (7.5–9 × 6.5–7.5 µm). Senn-Irlet & Immerzel (2003), however, reported utriform cystidia for other Japanese materials.

Another allied species is *C. citrinus* Petch from Sri Lanka. A type study by Pegler (1986) referred to clavate cylindric and often constricted cystidia, and apparently exclusively 4-spored basidia. Earlier, Singer (1973) reported *C. citrinus* as growing in montane subtropical forest in Argentina; he did mention the type from Sri Lanka but did not describe it. The Argentinean material and our *C. flavus* collection have a similar spore size (6.8–8.3 µm) but differ in the clavate to versiform cheilocystidia with frequent projections ("antler-like" in Senn-Irlet & Immerzeel 2003) and the 2–4-spored. Although Pegler (1986) did not report "antler-like" cystidia in the type and Pilát (1950)

had not referred to that feature, Senn-Irlet & Immerzeel (2003), who studied *C. citrinus* collections distant from the type locality (La Réunion and Puerto Rico), observed this feature. Special attention must be given to de Meijer (2008: 321), who reported rare antler-like cystidia in a Paraná collection of *C. citrinus* (he described them as having a "contorted apical appendage"). We follow the Senn-Irlet & Immerzeel (2003) species concept of this group and agree with Capelari (2011): we regard *C. flavus* as distinct from —but very similar to— *C. citrinus* and *C. sulphurinus* mainly by the cystidial shape. Morphological, phylogeographical, and molecular studies on a worldwide scale are necessary to elucidate whether or not all of these yellow species are different.

Crepidotus brunswickianus Speg. is another South American yellow species closely related to *C. flavus*. It was first described from Southern Argentinean forests by Spegazzini (1887) with a "pallide melleus" to "fulvo lutescens" pileus, concolorous lamellae, and basidiospores measuring 5–6 × 3–4 µm. It was later described from a montane zone in Venezuela as having cadmium yellow basidiomata, larger (7–8.5 × 6–7 µm) subglobose basidiospores, and vesicular to clavate cheilocystidia (Dennis 1961, 1970). Despite the close similarities in the descriptions, we believe that *C. brunswickianus* and *C. flavus* represent distinct species, although a revision is needed for the material identified in Dennis (1961).

Pereira (1990), Pegler (1997), Senn-Irlet & de Meijer (1998), de Meijer (2006, 2008) and Capelari (2007, 2011) reported several species of *Crepidotus*, and now we have the opportunity to record *C. flavus* for the first time in Northeast Brazil.

Entoloma aripoanum Dennis, Bull. Soc. Mycol. Fr. 69: 196. 1953. Fig. 2

Pileus ≤ 17 mm, plane-convex, with a central depression, surface white, glabrous, smooth; margin smooth, entire, slightly involute; context thin, fleshy, white, unchanging. Lamellae adnate to short decurrent, white, membranous, moderately crowded, with lamellulae. Stipe 36 × 3 mm, central, cylindrical, white, glabrous, smooth, with rhizomorphs, mycelium present at base. Odor strong, pleasant.

Basidiospores 10–11.5(–12.5) × 7–7.5 µm, x = 10.7 × 7.3 µm, Q = 1.30–1.50(–1.66), $Q x$ = 1.45, heterodiametric-elliptical, with 6–8 depressed facets, pink and moderately thick-walled. Basidia 32–42 × 10–11 µm, clavate, 2- or 4-spored. Pleurocystidia absent. Cheilocystidia 47–72 × 9–17 µm, cylindrical and some clavate, hyaline, thin walled. Pileitrama of exclusively hyphae similar to ones of lamella trama; vascular hyphae occasional, 5 µm wide. Pileipellis a cutis with erect hyphae 3.5–10 µm wide, hyaline. Lamella trama regular with hyphae ranging to 3.5–8.5 µm wide, apparently with yellowish brown granular cytoplasmatic contents. Clamp connections present.

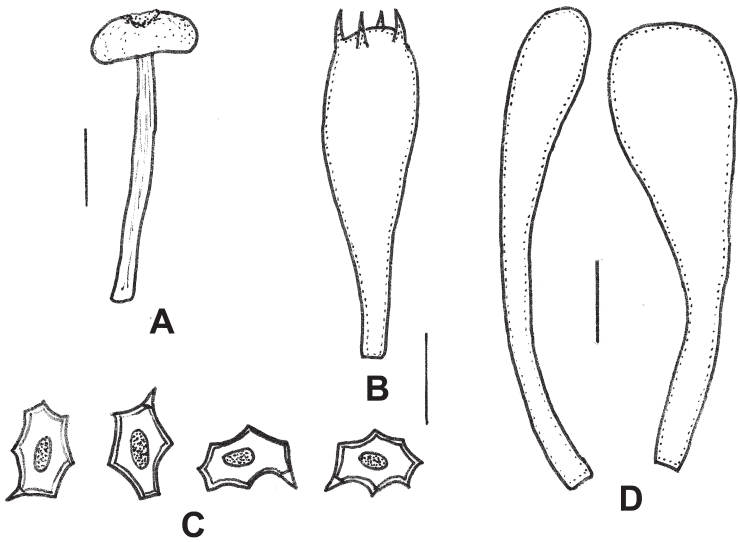

Figure 2. *Entoloma aripoanum*.
A. Basidiome. B. Basidium. C. Basidiospores. D. Cheilocystidia.
Scale bars: A = 10 mm; B–D = 10 µm.

Habitat: Solitary on rotten decayed wood in a tropical forest fragment.
Material examined: **BRAZIL. Pernambuco**, Igarassu, "Usina São José" ("Mata de Piedade"), 25.viii.2005, *F. Wartchow s.n.* (URM 80085).

Remarks: This is an interesting species recognized by the pure white basidiome with slightly depressed pileus centre, adnate to short decurrent lamellae, lignicolous habit, basidiospore size and shape, and clavate cheilocystidia (Baroni & Lodge 1998, as *Alboleptonia aripoana* (Dennis) Pegler). Cheilocystidia in our collection are slightly shorter than those in the Trinidad type as revised by Baroni & Lodge (1998), who reported cystidia 46–110 µm long, but the other features agree with the original description. Baroni & Lodge (1998) suggest that *A. aripoana* sensu Pegler (1983) represents a distinct species, based on the number of spore facets (8–10 in Pegler's Antillean specimen versus 6–8 in *E. aripoanum*). *Entoloma aripoanum* is known from Trinidad (Dennis 1953, Horak 1977), possibly also from Martinique and Dominica (Pegler 1983; but see Baroni & Lodge 1998), and now is reported for the first time from Brazil.

Entoloma tucuchense Dennis, Bull. Soc. Mycol. Fr. 69: 196. 1953. Fig.3

Pileus 35 mm, plane slightly convex, surface dark brown (M&P 8A12 "Autumn") radially striate-rimose showing the white context, disrupting in small granular squamules; context thin, fleshy, unchanging. Lamellae adnate,

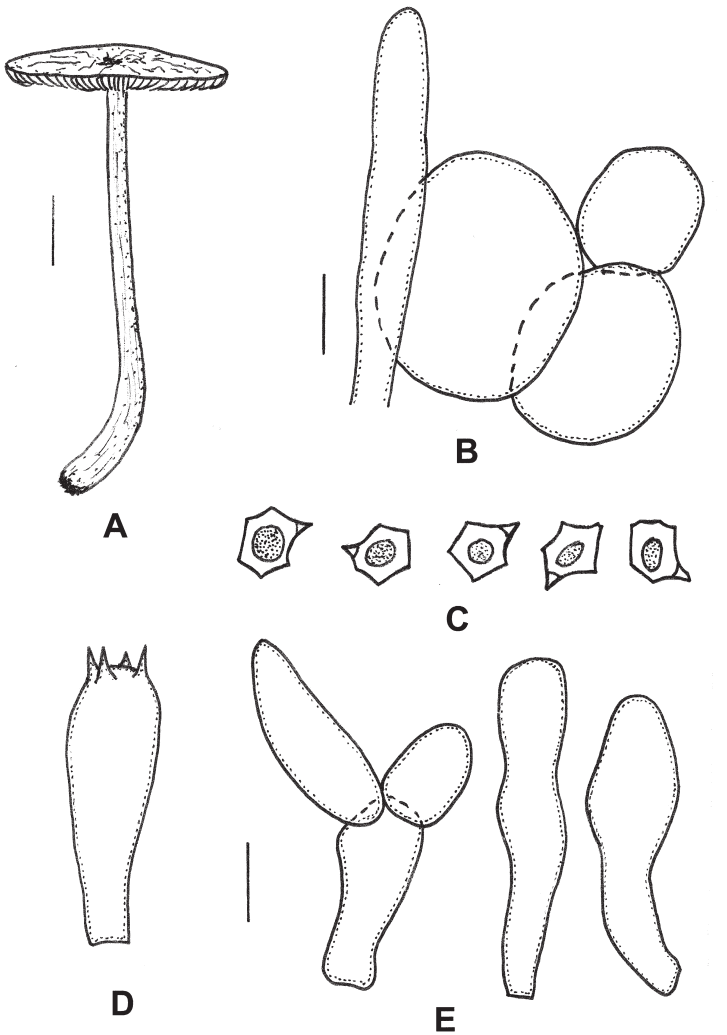

Figure 3. *Entoloma tucuchense*.
A. Habit. B. Pileipellis showing the inflated cells and tip on one of the erect cylindrical hyphae. C. Basidiospores. D. Basidium. E. Hyphoid terminal projections from lamella edge. Scale bars: A = 10 mm; B–E = 10 µm.

pale cinnamon pink, membranous, sub distant, with lamellulae. Stipe 66 × 4 mm, central cylindrical, surface pale grey, smooth, white at base because of the basal mycelium.

Basidiospores 8–9.5(–10) × 6.2–7.5 µm, x = 8.7 × 7 µm, Q = (1.13–) 1.18–1.30(–1.35), Qx = 1.24, subisodiametric-angular, with 5–6 facets, with thin pink walls. Basidia 35–40 × 11–12 µm, clavate, 4-spored. Pleurocystidia absent. Cheilocystidia absent, although pronounced catenate hyphae 27–52 × 7–13 µm, frequently cylindrical, hyaline to light yellowish brown pigmented sometimes arising from the lamellar trama. Pileitrama hyphae filamentous or inflated, ≤ 11 µm diam.; 5-µm vascular elements occasionally present. Pileipellis an epithelium composed of subglobose to ovoid elements 18–37 × 15–26 µm intermixed with dark brown erect cylindrical hyphae 52–82 × 7–15 µm. Lamella trama regular, hyphae filamentous, ≤ 4 µm diam. Clamp connections absent.

Habitat: solitary on soil near an unidentified angiosperm in a fragment of tropical rain forest.

Material examined: **BRAZIL. Pernambuco**, Igarassu, Usina São José ("Mata de Piedade"), 22.vii.2005, *F. Wartchow 18/2005* (URM 80086).

Remarks: This species and *Calliderma fibulatum* Karstedt & Capelari, *C. rimosum* Karstedt & Capelari, *C. caeruleosplendens* Largent et al., *Entoloma foldatsii* (Dennis) E. Horak, and *E. pruinatocutis* E. Horak are all characterized by a granulose (rimose in this case) pileus and distinctly hymeniform pileipellis, a very infrequent feature in *Entoloma* sensu lato (Horak 1977, Aime et al. 2010, Karstedt & Capelari 2010). Except for the lack of cystidioid projections in the type specimen, other features (i.e. radially sulcate pileus, basidiospore size) our material matches the type as analyzed by Horak (1977), Pegler [1983, as *Inopilus tucuchensis* (Dennis) Pegler], and Karstedt & Capelari (2010).

The recently described *Calliderma rimosum,* the most macroscopically similar taxon, differs from *E. tucuchense* in a pileus that cracks more strongly with age, a revolute pileal margin, sinuate (not adnate) lamellae, and cylindric, clavate to ventricose cheilocystidia (Karstedt & Capelari 2010).

Entoloma tucuchense, previously known from Trinidad (Dennis 1953) and Amazonas State, Brazil (Horak 1982), is newly reported from Pernambuco State, northeast Brazil.

Recent studies place *E. tucuchense* and other taxa with hymeniform pileipelli in *Calliderma* (Romagn.) Largent (Aime et al. 2010, Karstedt & Capelari 2010). However, other recent molecular studies support *Calliderma* as an integral part of a monophyletic *Entoloma* (Co-David et al. 2009).

Lepiota erinana Dennis, Kew Bull. 7: 484. 1952. Fig. 4

Pileus 6 mm, convex, surface covered with appressed vinaceous brown (M&P 4K11 "Lacquer R") squamules, cracking to reveal a pale cream background, but remaining entire at centre, margin entire, not sulcate, nor striate; context very thin, submembranous. Lamellae free, membranous, white, crowded, with lamellulae. Stipe 9 × 1 mm, central, cylindrical, surface concolorous with the

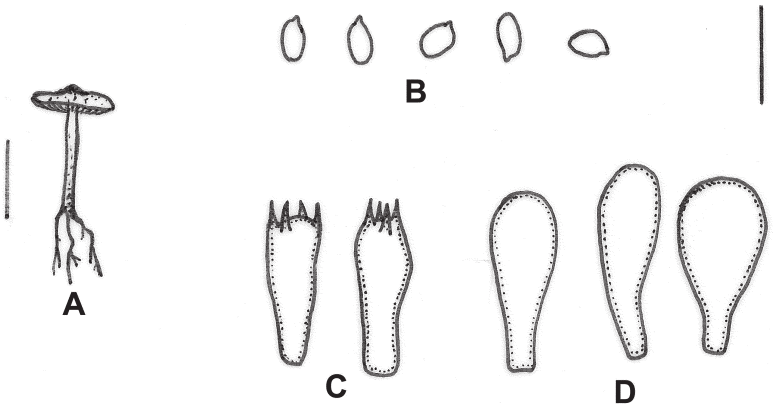

Figure 4. *Lepiota erinana*.
A. Basidiome. B. Basidiospores. C. Basidia. D. Cheilocystidia.
Scale bars: A = 5 mm; B–D = 10 µm.

pileus, with loose, floccose vinaceous brown squamules, rhizomorphs present. Annulus superior, ephemeral, and indistinct.

Basidiospores 4.5–5 × 2.5–3 µm, x = 4.6 × 2.7 µm, Q = (1.53–)1.62–1.78 (–1.88), Qx = 1.24, ellipsoid to elongate, thin walled, smooth, dextrinoid, hyaline. Basidia 15–17 × 5–6 µm, clavate, 2- or 4-spored. Pleurocystidia absent. Cheilocystidia 18–20 × 6–9 µm, inflate-clavate to clavate, thin walled, hyaline. Pileus covering a trichodermium comprising chains of cylindrical to subclavate hyphae with slightly thick walled light grayish terminal elements 37–47 × 5–6 µm. Lamella trama regular. Clamp connections present.

Habitat: solitary on humus in a fragment of tropical rain forest.

Material examined: **BRAZIL. Pernambuco**: Igarassu, Usina São José ("Mata de Piedade"), 22.vii.2005, *F. Wartchow 22/2005* (URM 78709).

Remarks: As far as we know, this small fragile species with a pileus ≤ 10 mm is known only from the Neotropics (Dennis 1952, Pegler 1983, de Meijer 2006, Rosa & Capelari 2009) and the very small size of our basidiome adds to what is known for *Lepiota erinana*. Known previously from Trinidad (Dennis 1952), Martinique and Venezuela (Pegler 1983), and Paraná (de Meijer 2006) and Minas Gerais (Rosa & Capelari 2009) states in Brazil, *L. erinana* is reported here for the first time from northeast Brazil.

Trogia cantharelloides (Mont.) Pat., Essai Taxon. Hymén.: 129. 1900.

Solitary on leaves and soil arising from a dense mycelium in litter in a tropical rain forest fragment.

Material examined: **BRAZIL. Pernambuco**: Igarassu, Usina São José ("Mata de Piedade"), 18.viii.2005, F. Wartchow (URM 78707).

Remarks: Singer (1965) previously reported *T. cantharelloides* was from Paraíba State, northeast Brazil. This is the first record from Pernambuco.

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